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U.S. AIR FORCE

TITLE

VISUAL INSPECTION STANDARDS FOR 30MM GAU-8/A CARTRIDGE CASE

SIZE	CAGE CODE	DWG NO.
A	98747	**SP200610303**

SCALE NONE SHEET 1 of 18

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1. SCOPE AND PURPOSE

1.1 Scope. This specification establishes the requirements for manufacture and acceptance of the Visual Inspection Standards for the 30MM GAU-8 Cartridge Case.

1.2 Purpose. The purpose of this standard is to provide a comparative basis for examining and dispositioning visual anomalies in 30mm GAU-8 Cartridge Cases. This document shall serve as a supplement to pertinent detail specifications and the applicable drawing. Further, this standard and the contents herein shall serve as an instruction manual in the training of personnel engaged in the inspection and acceptance of the 30mm GAU-8 Cartridge Case.

2. APPLICABLE DOCUMENTS

2.1 Government Documents. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein. In the event of conflict between documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

2.1.1 Specifications.

MIL-STD-1168	Lot Numbering of Ammunition
MIL-STD-1916	Department of Defense Test Method Standard
SP200610308	Case, Cartridge, 30mm

2.1.2 Drawings.

200610300	Cartridge Assembly, PGU-15A/B 30MM Target Practice
200610319	Cartridge Case, 30mm

2.2 Non-Government Documents. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated the issue in effect on date of invitation for bids or request for proposal shall apply. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

2.2.1 Specifications.

OTP 7500400	Visual Inspection Standards for 30mm Ammunition and Components

3. DEFINITIONS

3.1 Acceptable Defect. A condition which, though not desirable, is permitted for reasons of economy. These types of defects are considered non-detrimental in terms of fit/form/function of the Cartridge and/or the weapon system. Henceforth, the illustrations and language herein are intended to depict the degrees of such defects without penalty to the Cartridge Case lot.

3.2 Unacceptable Defect. A condition of substandard workmanship or material that poses a real or potential hazard to personnel and/or equipment, or that may have an adverse effect on assembly of the cartridge.

3.3 Tactile Inspection. Inspection that is performed via “feel”, i.e., with the fingernail.

3.4 V-Bottom. A condition in which the fore or aft end of a defect or anomaly is shaped like a sharp “V”. This condition can result in increased localized stress, and has the potential to propagate splitting and/or separation of the material.

3.5 Stress Riser. Defects (such as “V-bottom” or notches) that act to intensify the stress at their location.

3.6 Stain. A visible discoloration of certain metal surfaces or coatings as a result of exposure to acid, salt, or alkali products, moisture, and oxygen.

3.7 Foreign Matter. A discernible contamination or surface condition more specifically identified as oil, grease, dirt, chips, corrosive material, or any other substance alien to the Cartridge Case. The term foreign matter applies equally to both the internal and external surfaces of the Case.

4. CASE DEFECTS

4.1 General. Metal defectiveness shall be considered the result of a discontinuity or condition in the parent metal. Metal defectiveness can be identified as a roughness, scaling, impurity, or inlay in the raw material itself.

4.1.1 Galling. Galling appears as a scaly surface defect of the metal that is drawn or stretched upward in the longitudinal direction of the Cartridge Case, in the direction of the case mouth. Galling may appear in varying degrees of severity.

4.1.1.1 Acceptable Galling. The “scales” are visually identifiable, but do not appear to be highly concentrated. The severity of the galling is such that it is not readily detectable by tactile inspection. The galling does not have the appearance that the “scales” are folded over atop one another, allowing for material pockets under the defect. Acceptability for galling shall be a limitation of the condition to a ninety-degree (90º) slice of the periphery of the Cartridge Case.

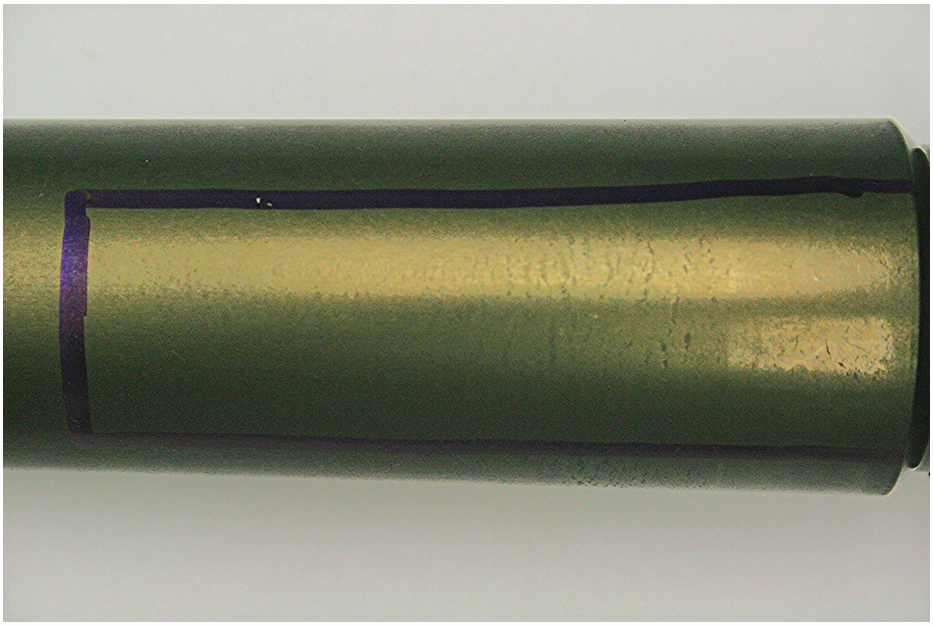

Figure 1. Acceptable Galling

4.1.1.2 Non-acceptable Galling. The “scales” may appear to be highly concentrated, and have the appearance of being folded over atop one another. Often, the scales can be readily detected by tactile inspection. There may appear to be “pockets” under the galled material. Galling that demonstrates the aforementioned criteria and/or exceeds a ninety-degree (90º) slice of the periphery of the Cartridge Case shall be considered defective.

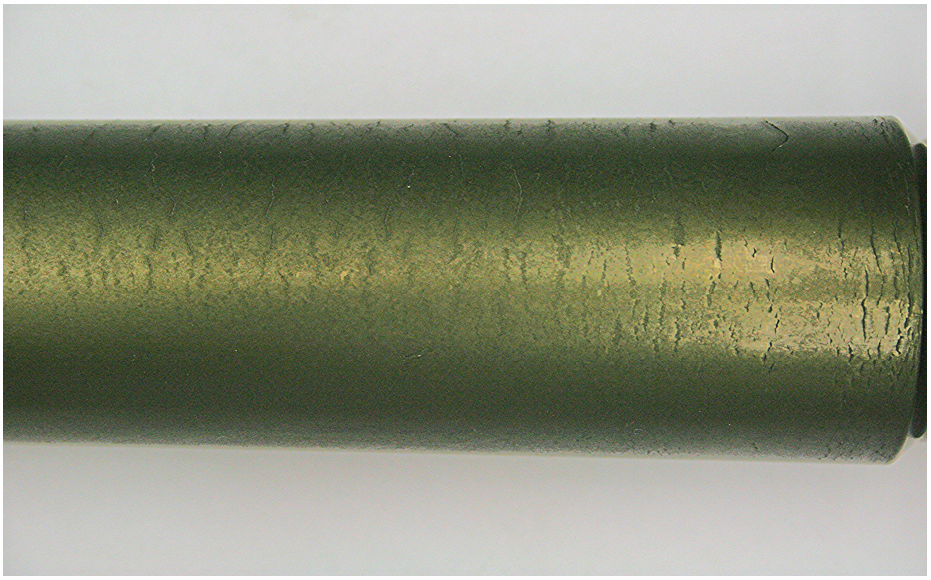

Figure 2. Unacceptable Galling

4.1.2 Pitting. Pitting appears as dark spots or erosions (pits) on the surface of the material and may vary in degree of concentration. The “pits” may not be readily detectable via tactile inspection; however, the depth of the erosion may propagate a considerable depth into the material in the transverse direction. Pitting is considered a rejectable defect, particularly in the shoulder-forward region of the Cartridge Case.

Figure 3. Unacceptable Pitting

4.1.3 Carbon Marks. Carbon marks appear as a grayish or black streaking in the longitudinal direction of the Cartridge Case. The “streaks” are generally flat in appearance and cannot be readily detected via tactile inspection, i.e., there is no raised metal or scaling associated with the condition. The streaking may appear as a single line or as multiple lines of varying length. Carbon marks are typically the result of material handling during the extrusion process at the material manufacturer.

4.1.3.1 Acceptable Carbon Marks. Acceptability for carbon marks shall be a limitation of the condition to a ninety-degree (90º) slice of the periphery of the Cartridge Case.

Figure 4. Acceptable Carbon Marks

Figure 5. Acceptable Carbon Marks

4.2 Split or Perforated. A split or perforated Cartridge Case is one that exhibits the condition of a separation of material, either partly or entirely through the wall. A split or perforated Cartridge Case may demonstrate the appearance of having been punctured. All splits or perforations shall be considered unacceptable.

4.3 Draw Scratch. Draw scratches are resultant of the manufacturing process, and are typically due to a die scratch or buildup in the die. Draw scratches can also be generated as the result of a material handling nick that propagates upward. The scratch in the die/buildup/nick is transferred to the Case wall, in the longitudinal direction. A draw scratch generally appears as one or more straight lines running in the longitudinal direction of the cartridge case. It is critical to ensure that draw scratches do not transverse the Cartridge Case shoulder/neck/mouth area(s), as they may cause the Case to split upon loading. The seriousness of a draw scratch is judged primarily by its depth; those draw scratches that can be detected readily via tactile inspection and/or calibrated scribe are to be considered unacceptable.

4.3.1 Acceptable Draw Scratch. Draw scratches that can be visually identified but cannot be felt with the fingernail are acceptable.

4.3.2 Unacceptable Draw Scratch. Any draw scratch that transverses the shoulder/neck/mouth area(s) of the Cartridge Case shall be considered unacceptable, regardless of detectable severity. Draw scratches that are readily identified via tactile inspection or via a calibrated scribe shall be considered unacceptable.

4.4 Scratch, Other Than Draw Scratch. Typically, scratches other than draw scratches are not characterized by a particular length, orientation, or location on the Cartridge Case; however, the profile of a scratch and the location of a scratch on the Cartridge Case are the most important criteria to evaluate in terms of determining its non-/acceptability. The profile of a scratch, particularly at the bottom, is critical in assessing a potential stress riser; scratches that are associated with a dent or concavity, other surface deformation, sharp crease, or "V-bottom" yield stresses that may cause the Cartridge Case to rupture. Longitudinally-oriented scratches that can be readily detected by feel are not as much of a concern as completely circumferential scratches (scratches that go around complete periphery of Cartridge Case), as circumferential scratches can potentially yield Cartridge Case separations.

4.4.1 Acceptable Scratch, Other Than Draw Scratch. A scratch on the Cartridge Case body (shoulder – back) that is detectable via tactile inspection and/or calibrated scribe regardless of orientation shall be considered acceptable, provided it is:

a. Not longer than 1 inch in length.

b. There is no significant width (fingernail/scribe does not easily move from side to side within the scratch).

c. There does not exist a "V-bottom" or sharp crease on any side/end of the scratch.

d. There is not a dent/other surface deformation associated with the scratch.

e. There is no raised metal associated with the scratch.

A hairline exposure of bare metal shall be considered acceptable provided that it is less than 1 inch in length and no metal is displaced. The aforementioned criteria shall also be considered acceptable for scratches in the extractor groove of the Cartridge Case. "Rub marks" shall be considered acceptable; if a "rub mark" is associated with a scratch, the scratch must conform to the provisions as aforementioned.

4.4.2 Unacceptable Scratch, Other Than Draw Scratch**.** Any scratches (regardless of detectable severity) that transverse the shoulder/neck/mouth area(s) shall be considered unacceptable. A completely circumferential scratch (scratch goes around complete periphery of Case) that is readily detectable by feel shall be rejected.

4.4.3 Scratch Inside the Mouth. Scratches inside the Cartridge Case mouth may appear in a longitudinal or circumferential orientation, in varying degrees of severity. Scratches inside the Cartridge Case mouth shall be assessed closely, as they can damage the projectile upon insertion and/or yield a leak path. Occasionally, the Cartridge Case manufacturing process can generate scratches inside the mouth that appear more as a "burnishing" or surface finish type of anomaly. These scratches are generally considered acceptable, so long as the condition meets the following criteria:

a. The scratch/condition cannot be readily detected via tactile inspection.

b. The scratch/condition is not associated with a rolled edge/raised material.

c. The scratch/condition does not interfere with the gauging requirements for inside mouth diameter.

d. The scratch/condition is within the first 1/8 inch from the Cartridge Case mouth opening.

e. The scratch/condition does not exceed a 63 surface finish, as specified by the drawing.

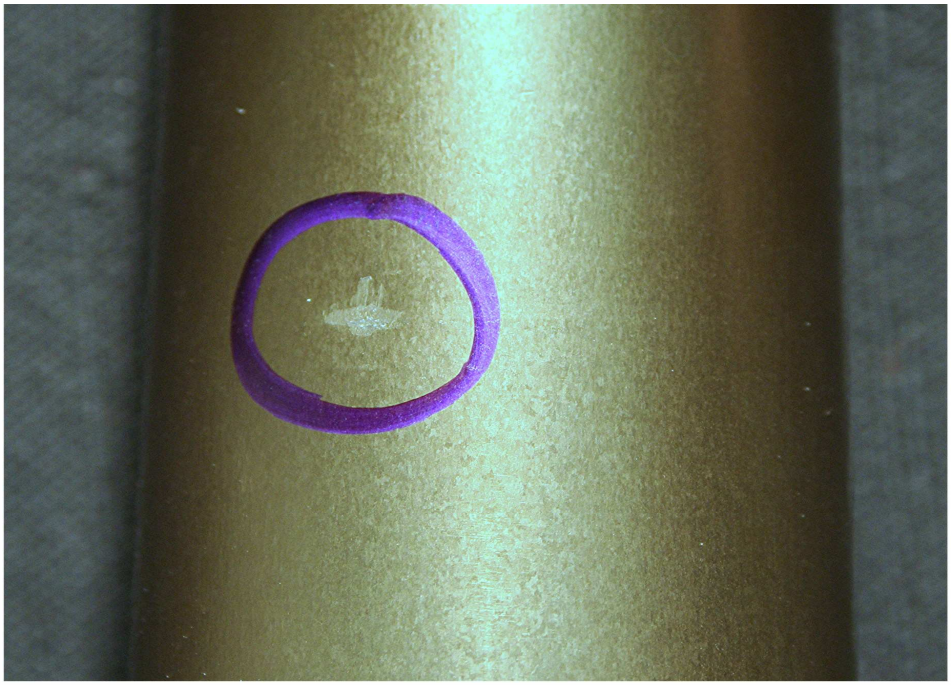

Figure 6. Acceptable Body Scratch

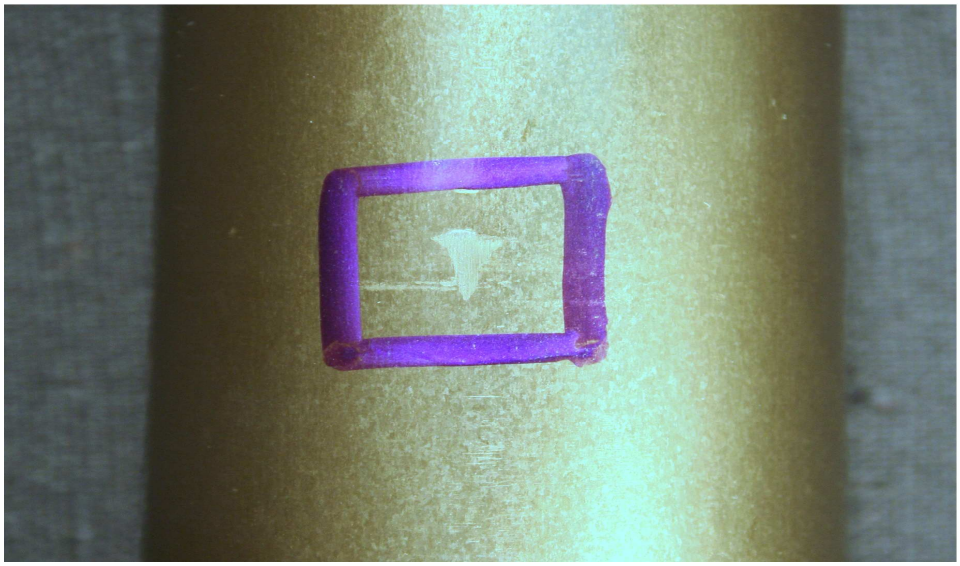

Figure 7. Acceptable Body Scratch

Figure 8. Acceptable Body Scratch

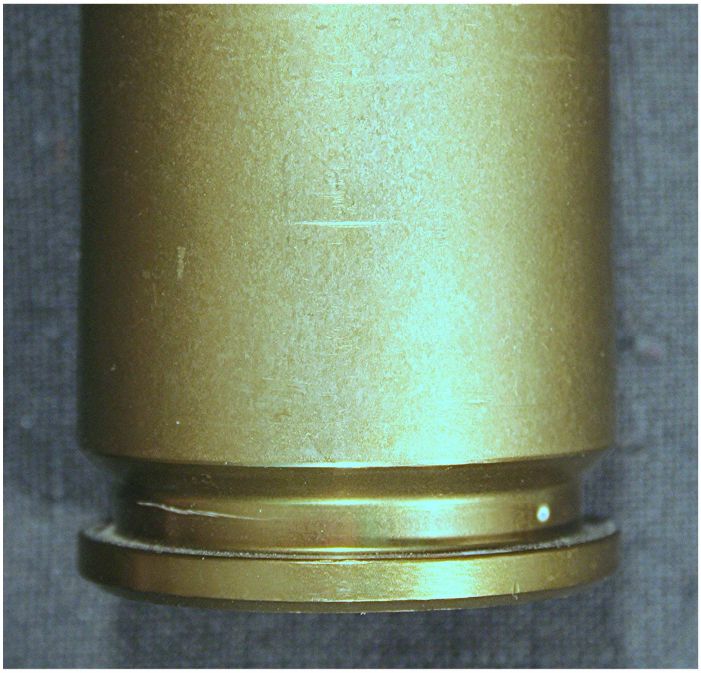

Figure 9. Acceptable Groove Scratch

Figure 10. Acceptable Scratch in Mouth

4.5 Nicks and Cuts. A nick or cut is generally incurred as the result of material handling, at any point in the manufacturing process.

4.5.1 Acceptable Nicks and Cuts**.** A nick or cut on the Cartridge Case body (shoulder – back) that is detectable via tactile inspection and/or calibrated scribe regardless of orientation, shall be considered acceptable, provided that:

a. Nicks or cuts on the Cartridge Case flange (head) do not interfere with the gauging requirements for flange thickness and/or diameter (refer to Damaged Extractor Groove/Head Configuration).

b. There does not exist a "V-bottom" or sharp crease on any side/end of the nick/cut.

c. There is not a dent/other surface deformation associated with the nick/cut.

d. There is no raised metal associated with nick/cut.

A nick or cut exposing bare metal shall be considered acceptable so long as the bare metal exposure does not exceed one inch in length. A slight nick on the outside of the Cartridge Case mouth chamfer shall be considered acceptable so long as the nick does not interfere with mouth outside diameter gauging requirements and there is not significant metal deformation/displacement associated with the nick. The nick must be isolated to the Cartridge Case exterior and cannot extend beyond the chamfer area of the mouth.

4.5.2 Unacceptable Nicks and Cuts**.** A nick or cut in the shoulder/inside mouth/neck area of the Cartridge Case shall be considered unacceptable.

4.5.3 Primer Pocket Nick. A primer pocket nick is generally observed as a flat indentation on the top (lead-in radius) of the primer pocket cavity and does not pose concern in terms of assembly/functionality provided there exists no protrusion (raise) of metal into the diametrical cavity. However, damage to the primer pocket that exhibits any of the aforementioned conditions, i.e., raised material, could potentially affect the load assembly and Pack (LAP) process.

4.5.3.1 Acceptable Primer Pocket Nick. Primer pocket nicks are permissible so long as they are present on the lead-in radius only. Any nicks that protrude into the diametrical cavity or present a condition of raised metal are not allowed. If a nick is readily felt with the fingernail, it shall be examined under lighted magnification to ensure that it does not protrude into the primer diametrical cavity. Provisions shall be considered for slight broken anodize plating in the location adjacent a primer pocket nick; this provision is also applicable to any re-worked Cartridge Case (see Unacceptable, below).

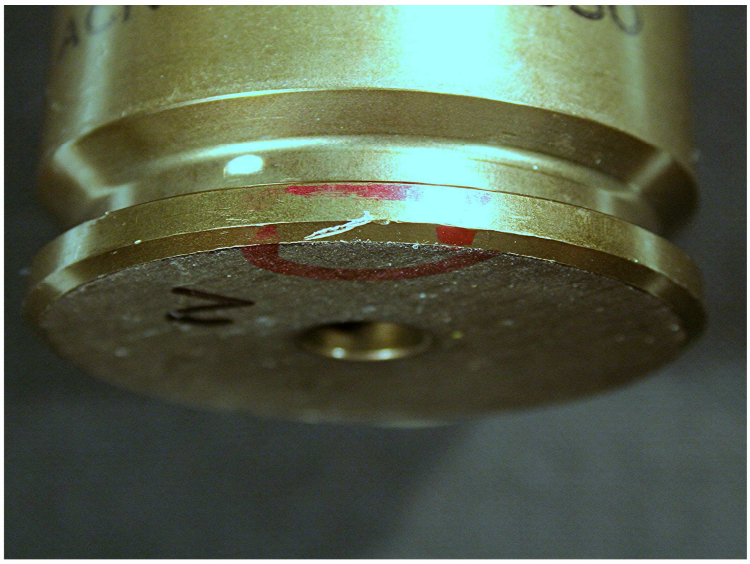

Figure 11. Acceptable Flange Nick

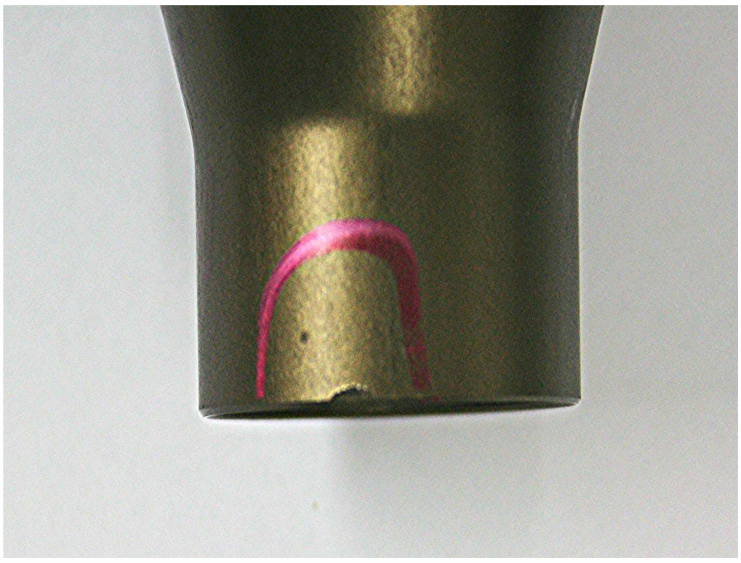

Figure 12. Acceptable Mouth Nick

4.5.3.2 Unacceptable Primer Pocket Nick**.** Nicks exhibiting a condition of raised metal and/or protruding into the cavity beyond the lead-in radius shall be considered unacceptable. Nicks present in Multiple locations around the periphery of the cavity shall also be considered unacceptable. If an approved rework procedure is available for utilization, Cartridge Cases exhibiting the aforementioned conditions may be candidates for rework.

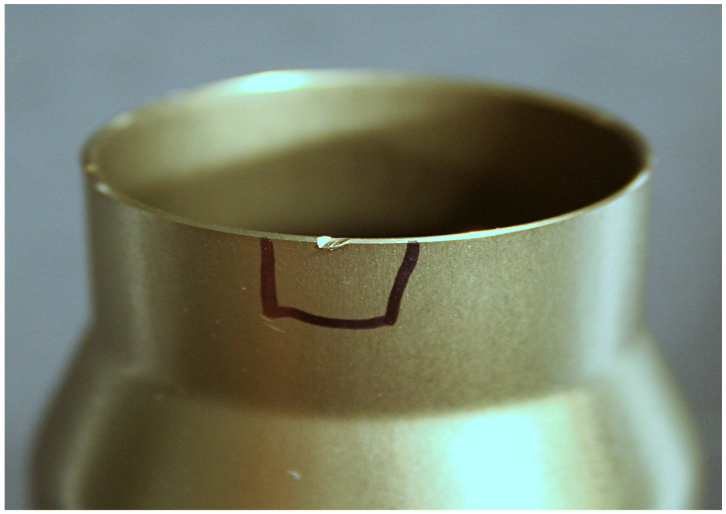

Figure 13. Unacceptable Mouth Nick

4.6 Dents and Other Surface Indentations. A dent or surface indentation can be generated as the result of a number of factors in the Cartridge Case manufacturing process. Typically, dents or other surface indentations result from material handling or issues with lubrication during the early forming operations.

4.6.1 Acceptable Dents and Other Surface Indentations**.** A dent or other surface indentation on the Cartridge Case body (shoulder – back) shall be considered acceptable, provided that:

a. The dent/indentation is considered “flat” and concavity resulting in a protrusion that cannot be detected on the Cartridge Case interior.

b. There does not exist a “V-bottom” or sharp crease on any side/end of the dent/indentation. The dent does not involve a nick, scratch, or gouge.

c. There is a smooth blend/transition to the adjacent surface of the Cartridge Case.

4.6.2 Unacceptable Dents and Other Surface Indentations**.** Any protrusion in the shoulder/inside mouth/neck area of the Cartridge Case shall be considered unacceptable.

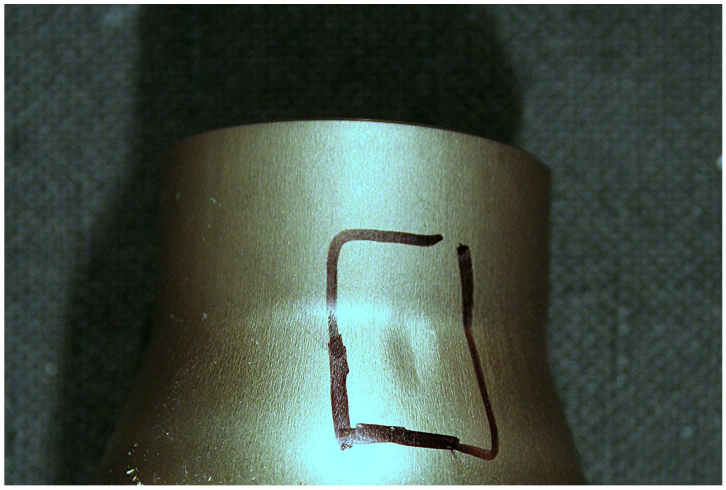

Figure 14. Unacceptable Shoulder Dent

4.7 Wrinkle. In general, a wrinkle is metal waviness in the neck or shoulder region of the Cartridge Case, caused during the forming operation(s).

4.7.1 Acceptable Wrinkle**.** A slight degree of wrinkling/waviness shall be considered, i.e., a degree of condition that is barely detectable via tactile inspection. The condition cannot transverse past the shoulder/neck region of the Cartridge Case, and the Cartridge Case must be examined to ensure that it meets all profile requirements.

4.7.2 Unacceptable Wrinkle**.** Metal wrinkling/waviness associated with folds and/or sharp creases that are detectable via tactile inspection and/or transverses past the neck/shoulder region of the Cartridge Case shall not be considered for acceptance.

4.8 Damaged Extractor Groove. Damage to the extractor groove of the Cartridge Case is most often the result of the machining operation, material handling, or removal of the unit from the anodizing rack. Damage incurred to the extractor groove must be closely evaluated to ensure that the damage does not affect extractor of the Cartridge Case from the weapon system.

4.8.1 Acceptable Damaged Extractor Groove**.** Damage to the underside of the head rim that does not demonstrate a condition of raised or significantly displaced material and does not interfere with gauging requirements for rim thickness, rim diameter, or groove diameter shall be considered acceptable. Exposure of bare metal in the extractor groove not longer than one inch in length shall be considered acceptable.

4.8.2 Unacceptable Damaged Extractor Groove**.** Any damage to the extractor groove, which causes a deformation and/or raised metal/burrs, to the underside of the head rim shall be considered unacceptable.

4.9 Cartridge Case Identification. Cartridge Case identification is essential to the traceability of the Cartridge Case to its parent lot. Traceability to the parent lot is inclusive of traceability to the manufacturer and the time during which the lot was produced, and all materials utilized in production.

4.9.1 Acceptable Cartridge Case Identification**.** In general, identification marking shall be considered acceptable if under "normal" lighting conditions and at a distance of approximately 18 inch from the human eye (without magnification) the characters are clear, legible, and recognizable. All lot numbering shall be in accordance with MIL-STD-1168.

4.9.2 Unacceptable Cartridge Case Identification**.** Any identification markings which are missing (in whole or part), faded, smeared, blurred, or dislodged to the extent that they cannot be readily identified under normal conditions shall be considered unacceptable.

4.10 Burrs and Sharp Edges. Burrs and sharp edges on the Cartridge Case, particularly in the primer pocket cavity, shall be considered unacceptable.

4.11 Cracks and Laminations. Cracks and laminations on the Cartridge Case shall be considered unacceptable.

4.12 Folds. Folds are generally incurred as part of the Cartridge Case manufacturing process, and are most often the result of poor trim. Occasionally, a line fold can be directly linked to a draw scratch; the only discernable feature, however, is that the line fold can be detected on the Cartridge Case interior. In general, folds shall be considered an unacceptable condition. Any such defect that transverses the neck/shoulder and into the mouth area causes a potential stress riser and can pose the threat of a Case split. Detectability of a fold on the Case interior via tactile inspection shall be a major criteria for acceptability.

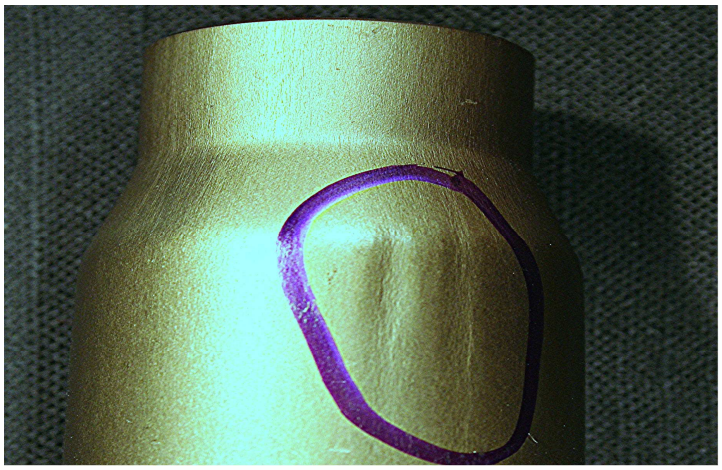

Figure 15. Unacceptable Fold

4.13 Damaged Protective Coating. Damaged protective coating generally results from material handling following the anodize/seal operation. Damaged protective coating can also be a result of improper gauging and measurement technique.

4.13.1. Acceptable Damaged Protective Coating**.** Damaged protective coating on the Cartridge Case body shall be considered acceptable provided the following criteria are met:

a. The damaged coating yields only a hairline exposure of bare metal on the Cartridge Case body and is not greater than 1 inch in length and does not demonstrate a displacement of metal.

b. A line of bare metal along the edge of the head rim (flange) is not longer than 1 inch along the circumference.

4.13.2 Unacceptable Damaged Protective Coating**.** Any scrape or abrasion exposing a significant area of bare metal shall be considered unacceptable.

4.14 General Workmanship. General workmanship defects shall be those defects not appropriately classified into a specific visual defect category. General workmanship shall be reviewed and approved on a correct-and-proceed basis. General workmanship defects shall be evaluated accordingly for location and size (width, depth, length) of defect prior to assigning a disposition.

Figure 16. Acceptable Workmanship

Figure 17. Acceptable Workmanship

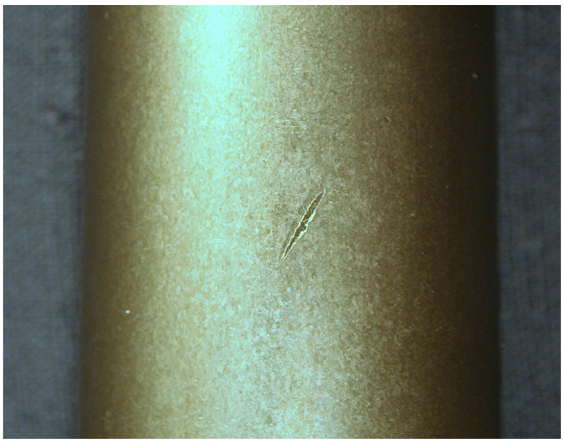

Figure 18. Acceptable Workmanship

Figure 19. Unacceptable Workmanship